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Risk Assessment Model -- Calculation of Potential Risks from Consumption of Human Milk

Chemical	Conc in Fish Cf (mg/kg)	Slope Factor SFo (mg/kg/day)-1	Intermediate MRL (mg/kg/day)	Chronic RfD (mg/kg/day)	Half-life h (days)	Mother ADDm (mg/kg/day)	Milk Cmf (mg/kg-lipid)	Fraction of human milk that is fat	Infant ADDca-i (mg/kg/day)	Infant ADDnc-i (mg/kg/day)	Infant/Mother Exposure Ratio	Excess Lifetime Cancer Risk Mother ELCRm	Excess Lifetime Cancer Risk Infant ELCRi	Infant/Mother Risk Ratio	Hazard Quotient Mother HQm	Hazard Quotient Infant HQi	Infant/Mother Risk Ratio
Total PCBs (1 year)	1	2	0.00003	0.00002	2555	0.000273	3.02	0.04	0.00011	0.00735	27	2.3E-04	2.1E-04	0.90	14	245	18
Total PCBs (0.5 yr)	1	2	0.00003	0.00002	2555	0.000273	3.02	0.04	0.00019	0.01304	48	2.3E-04	3.7E-04	1.59	14	435	32
PCB 153 (0.5 yr)	1	2	0.00003	0.00002	1387	0.000273	1.64	0.04	0.00010	0.0071	26	2.3E-04	2.0E-04	0.86	14	236	17
PCB 153 (0.5 yr)	1	2	0.00003	0.00002	1387	0.000273	1.64	0.08	0.00020	0.0142	52	2.3E-04	4.1E-04	1.73	14	473	35
PCB 153 (0.5 yr)	1	2	0.00003	0.00002	10038	0.000273	5.94	0.04	0.00037	0.0256	94	2.3E-04	7.3E-04	3.1	14	853	62
PCB 153 (0.5 yr)	1	2	0.00003	0.00002	10038	0.000273	5.94	0.08	0.00073	0.0512	187	2.3E-04	1.5E-03	6.2	14	1705	125
PCB 153 (1 year)	1	2	0.00003	0.00002	1387	0.000273	1.64	0.04	0.00006	0.0040	15	2.3E-04	1.1E-04	0.49	14	134	10
PCB 153 (1 year)	1	2	0.00003	0.00002	10038	0.000273	5.94	0.04	0.00021	0.0144	52	2.3E-04	4.1E-04	1.7	14	478	35

Notes:
Acceptable levels are ELCR = 1E-6 and HQ = 1

Equations

ADDm = (Cf x Irf x Conv2 x Ff) / BWm

Cmf = (ADDm x h x f1) / (ln2 x f2) for 7 year halflife   Cmf = (ADDm x h x f1)*0.5 / (ln2 x f2) for 27.5 year halflife

ADDca-i = (Cmf x IRMadj x f3 x f4 x f5 x Edi x Efi) / (Ati)   ADDnc-i = (Cmf x IRMadj x f3 x f4 x f5)

ELCRm = ADDm x Sfo x 30 / 70   ELCRm adjusted to 30-year exposure   HQm = ADDm / RfD

ELCRi = ADDca-i x Sfo   HQi = ADDnc-i / MRL

Default Values

Cf	chemical specific	mg/kg	Concentration of chemical in fish
Irf	17.5	g/day	Mother's ingestion rate of fish
Conv	0.001	kg/g	Conversion factor
Ff	1	fraction	Fraction of fish contaminated
BWm	64	kg	Body weight of mother
h	chemical specific	days	Half-life of chemical in body
Fone	0.9	fraction	Fraction of ingested chemical stored in fat
Ftwo	0.3	fraction	Fraction of mother's weight that is fat
IRMadj	0.149	kg/kg/day	Infant's ingestion rate of milk (averaged over exposure duration)
Fthree	0.04	fraction	Fraction of human milk that is fat
Ffour	0.9	fraction	Fraction of ingested chemical that is absorbed
Ffive	0.543	fraction	Fraction of initial chem conc present during year
Edi	1	year	Exposure duration of breast-feeding infant
Efi	365	days/year	Exposure frequency of breast-feeding infant
Atc	25550	days	Averaging time - carcinogens (70 years)
Sfo	chemical specific	(mg/kg/day)-1	Slope Factor - oral
RfD	chemical specific	mg/kg/day	Reference Dose - oral
Conv2	1.00E-06	kg/mg	Conversion factor 2

Calculated Values

ADDm	mg/kg/day	Average Daily Dose to mother
Cmf	mg/kg-lipid	Chemical concentration in milkfat
ADDca-i	mg/kg/day	Average Daily Dose to breast-feeding infant, cancer
ADDnc-i	mg/kg/day	Average Daily Dose to breast-feeding infant, non-cancer
ELCRm	risk	Excess Lifetime Cancer Risk to mother
ELCRi	risk	Excess Lifetime Cancer Risk to infant
HQm	quotient	Hazard Quotient to mother
HQi	quotient	Hazard Quotient to infant

Calculation of F5 (see Attachment 2 to Appendix C of draft DEQ Human Health Risk Assessment Guidance)

k	calculated	(days)-1	rate constant for chemical loss in body = ln(2)/h
b	0.9	kg/day	daily secretion of milk
c	calculated	fraction	fraction of chemical lost in human milk per day
hb	calculated	days	maternal half-life for breastfeeding
kb	calculated	(days)-1	rate constant for chemical loss by breast feeding = ln(2)/hb
			kb = k + c = k + b x f1 x f3 / (BWm x f2)
b'0	150	ml/kg/day	mean milk intake rate 0 to 3 months
b'91	140	ml/kg/day	mean milk intake rate 3 to 6 months
b'183	110	ml/kg/day	mean milk intake rate 6 to 9 months
	83	ml/kg/day	mean milk intake rate 9 to 12 months
	145	ml/kg/day	mean milk intake rate 0 to 6 months
	121	ml/kg/day	mean milk intake rate 0 to 12 months
	1.03	g/ml	density of milk
	149	g/day	mean milk intake rate 0 to 6 months
	0.149	kg/kg/day	mean milk intake rate 0 to 6 months
	124	g/day	mean milk intake rate 0 to 12 months
	0.124	kg/kg/day	mean milk intake rate 0 to 12 months

Half-life h (days)	k	kb	Cmilkfat91 Cmilkfat0	Cmilkfat183 Cmilkfat0	b'91 b'0	b'183 b'0	Six months of exposure f5	One year of exposure f5	Maternal Breastfeeding Halflife hb (days)
1387	0.000500	0.00219	0.861	0.746	0.933	0.733	0.803	0.547	317
2555	0.000271	0.00196	0.859	0.740	0.933	0.733	0.802	0.543	354
10038	0.000069	0.00176	0.858	0.736	0.933	0.733	0.801	0.540	395
									approximately 1 year